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Neurofeedback for ADHD: Significant, Lasting Improvement

Megan Brooks | February 26, 2014

Computer-based neurofeedback can produce significant and lasting improvement in attention and focus in children with attention-deficit/hyperactivity disorder (ADHD) and is superior to computer-based cognitive training (CT), new research shows.

Results from a randomized controlled trial showed that children who received computer-based neurofeedback made faster and greater improvements in ADHD symptoms, which were sustained at the 6- month follow-up, than their peers who received computer CT.

"Sustainability of improvements after a behavioral intervention is not usually found, and an important finding," Naomi Steiner, MD, of the Floating Hospital for Children at Tufts Medical Center in Boston, Massachusetts, told *Medscape Medical News.*

Dr. Steiner noted that it was also important that the study was carried out in the school setting.

"Most neurofeedback studies take place in the lab or in a clinic setting. This is translational research," she said.

The study was published online February 17 in *Pediatrics.*

Helpful With or Without Meds

Neurofeedback and CT are 2 forms of computer-based attention training. Neurofeedback trains users with electroencephalographic sensors embedded in a bicycle helmet to increase their beta waves (an attentive state) and to suppress theta waves (a drowsy state) when viewing their brain waves on a computer screen. CT involves cognitive exercises that focus on attention and working memory with computer feedback to reinforce correct responses.

The Boston team randomly assigned 104 children in second and fourth grade with ADHD to receive in-school neurofeedback (Play Attention, Unique Logic and Technology Inc), CT (Captain's Log, BrainTrain), or a control condition.

Both neurofeedback and CT groups received 3 45-minute intervention sessions each week in the classroom for a total of 40 sessions under the supervision of a research assistant.

Observations before and immediately after the interventions, reported previously by the investigators, showed significantly greater improvements in ADHD symptoms, including attention and executive functioning, in the neurofeedback group relative to the CT or control condition groups.

The investigators now report outcomes at 6 months postintervention, which show a similar pattern.

Children who received neurofeedback maintained significant gains on the Conners 3–Parent Assessment Report for inattention (effect size [ES] = 0.34), executive functioning (ES = 0.25), and hyperactivity/impulsivity (ES = 0.23) and on the Behavior Rating Inventory of Executive Function Parent Form (BRIEF) subscales, including the global executive composite (ES = 0.31), "which remained significantly greater than gains found among children in CT and control conditions," they report.

Children who received CT showed delayed improvement over immediate postintervention ratings only on Conners 3–Parent Assessment Report executive functioning (ES = 0.18) and 2 BRIEF subscales.

There were no differences between neurofeedback and CT on classroom observation measures.

The investigators say that it is "noteworthy" that children in the neurofeedback group maintained their stimulant medication dose while presumably experiencing the same physical growth and increased school demands as children in the CT and control groups, whose medication dosage increased by 9 to 13 mg methylphenidate-equivalent units.

It is also worth noting that the study included children who were on and off stimulant medication.

"Most studies do not included children on medication. However, we found that children on stimulant medication in the neurofeedback group improved as much as the children who were not on medication.

"This is very important clinically because it suggests that children on stimulant medication can also benefit from doing neurofeedback to train their attention and executive function," Dr. Steiner said.

Both neurofeedback and CT systems are currently being used in school systems across the United States, the investigators note in their article.

"Per session," Dr. Steiner said, "computer cognitive attention training is going to be cheaper than neurofeedback. However, as the results in the neurofeedback group are not only greater but also in more areas and were sustained, the long-term cost/benefit calculation might shift."

Promising Treatment

Commenting on the findings for *Medscape Medical News*, Martijn Arns, PhD, researcher in the Department of Experimental Psychology at Utrecht University in the Netherlands and director of the Research Institute Brainclinics, said the study contributes more evidence that "neurofeedback in the treatment of ADHD has clinical benefit, and that these effects seem to be maintained across time."

Dr. Arns, who was not involved in this research, noted that the effect sizes reported for neurofeedback in this study are "slightly lower" than what he and his colleagues found in a previous meta-analysis (Arns et al, *Clin EEG Neurosci,* 2009;40:180-189).

"Most likely, the fact that neurofeedback was implemented in a school setting in a standardized way might explain the slightly lower effects as compared to studies that employed neurofeedback in a clinical setting. On the other hand, it does demonstrate that such a treatment can be implemented in a school setting," Dr. Arns said.

"Recent studies have demonstrated limitations of medication in the long term; hence, treatments that have more sustained effects in ADHD are much needed," Dr. Arns added. Neurofeedback is a "promising avenue for the treatment of ADHD," he concluded.

The study was supported by an Institute of Education Sciences grant. The authors and Dr. Arns report no relevant financial relationships.

Pediatrics. 2014;133:483-492. Abstract

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Cite this article: Neurofeedback for ADHD: Significant, Lasting Improvement. *Medscape*. Feb 26, 2014.